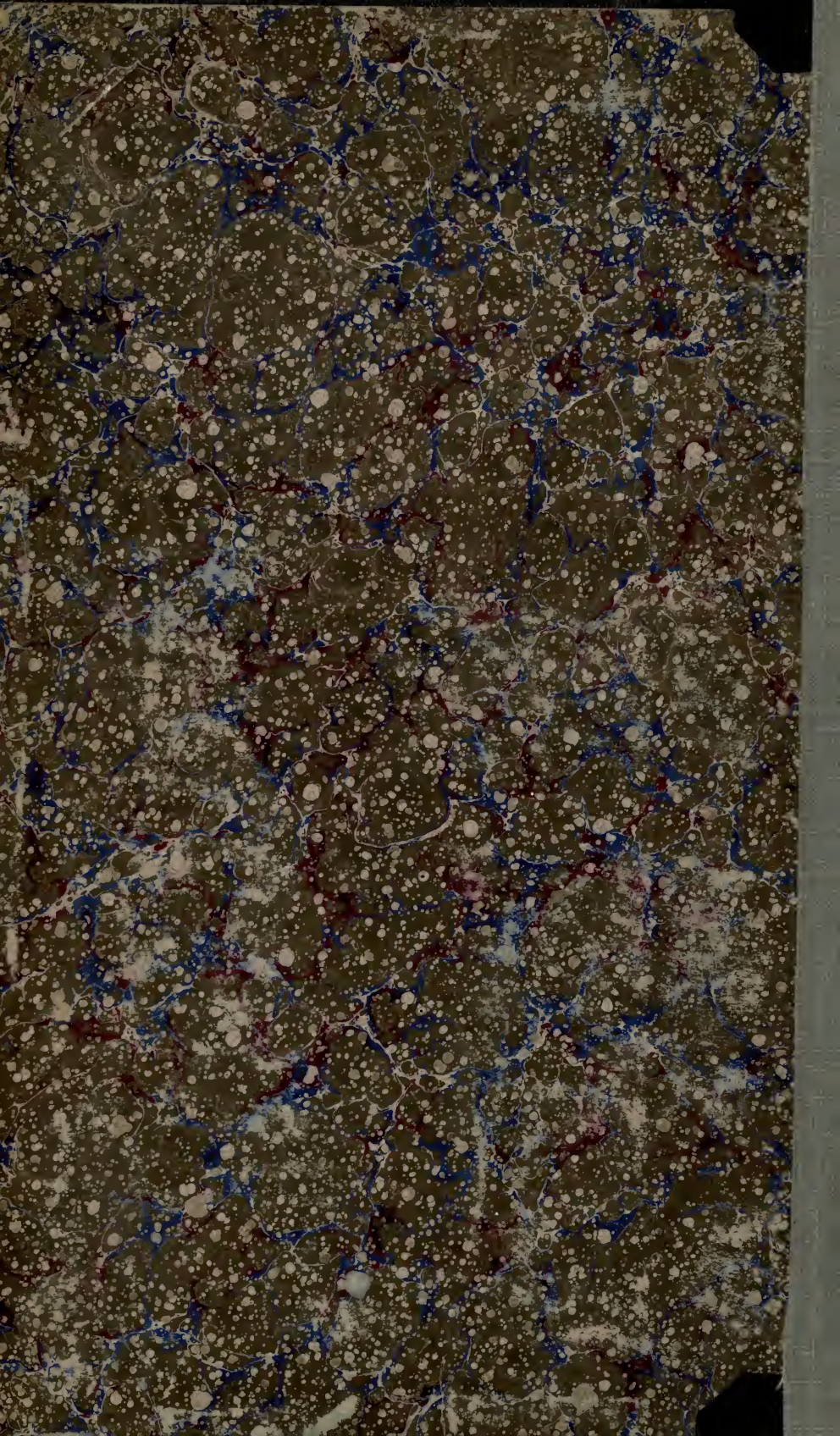
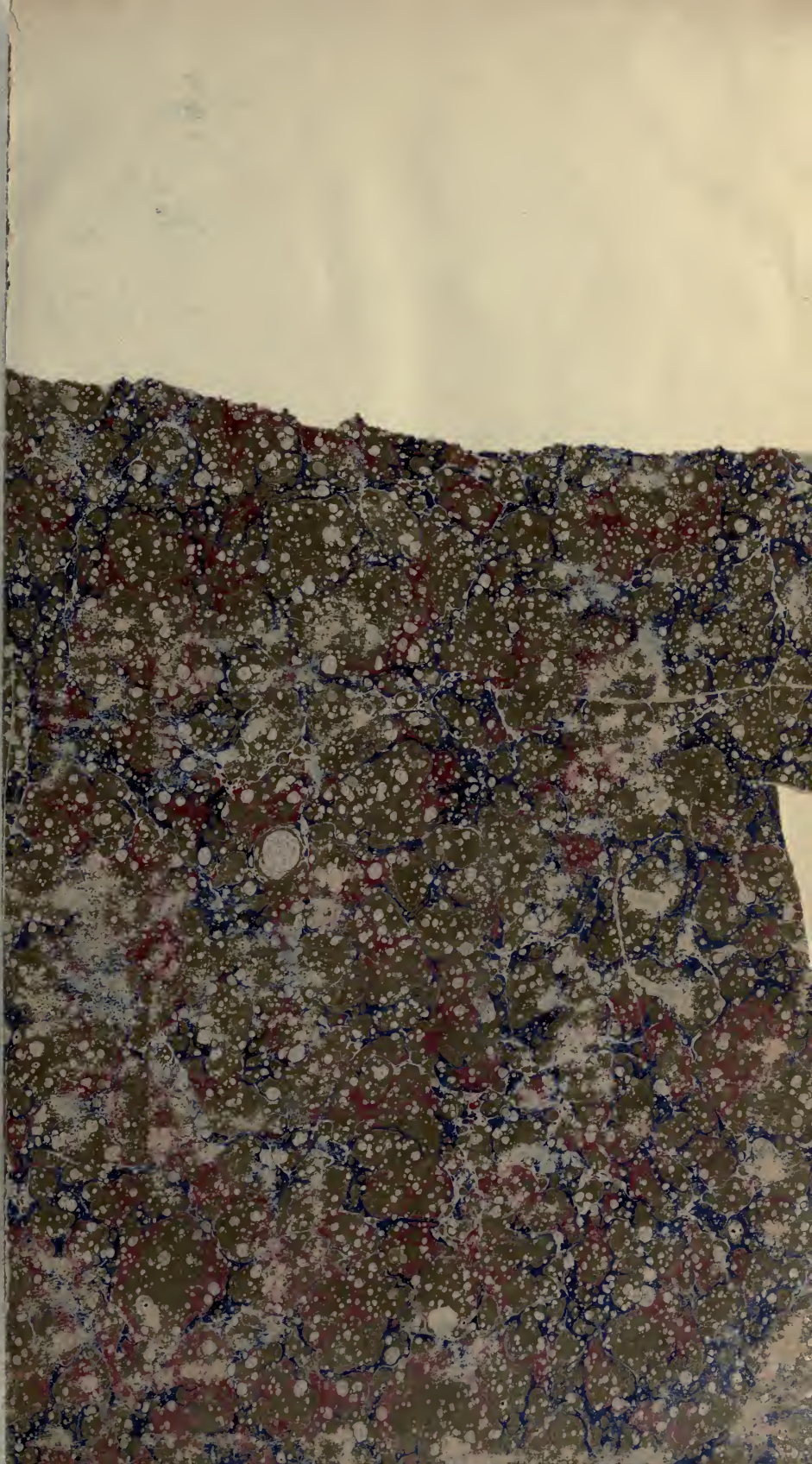
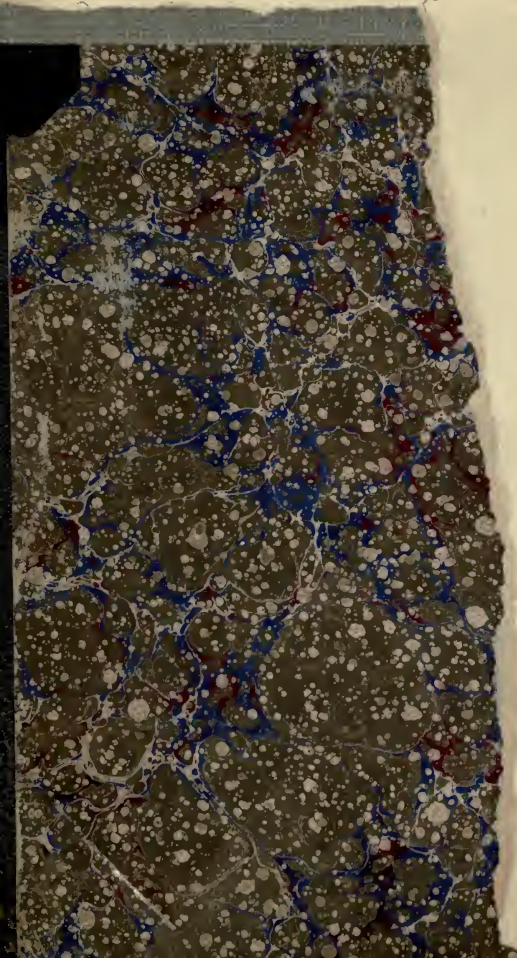
YD 22517







Digitized by the Internet Archive
in 2007 with funding from
Microsoft Corporation

http://www.archive.org/details/scienceinpublics00davirich

LIBRARY OF THE UNIVERSITY OF CALIFORNIA.

SCIENCE IN PUBLIC SCHOOLS, ETC., ETC.

BY GEORGE DAVIDSON.

FROM "MINING AND SCIENTIFIC PRESS."

LB41
P3
v. 13
*

48777

LIBRARY OF THE UNIVERSITY OF CALIFORNIA

California Academy of Sciences.

Annual Address of the President, Prof. Geo. Davidson, A. M. P. H. D., Jan. 3, 1882.

The reports of the officers convey to the members the details of the business of the Academy.

We have the satisfaction of knowing that a continued interst is manifested in the work of the members, and that a more general encouragement is extended to our efforts to increase scientific study and investigation. Yet we cannot but acknowledge that we need more workers and specialists in many valuable fields of research.

One main drawback to enlisting investigators is our present financial inability to print the proceedings of the Academy, either promptly as bulletins, when the interest and value of a communication would warrant it, or at the end of the year when the regular volume is closed. You have been assured personally by Agassiz, Hooker, Gray, Hayden and others that to impart vitality to such an institution, its proceedings must be systematically printed and spread abroad. In the rivalry which naturally exists among investigators, their scientific reputation depends upon their priority, as well as their ability. The principle and sentiment involved are as praiseworthy, and, in one sense, as valuable as the claim for originality on the part of the inventor.

I believe if we had the means to print, that we should experience a large and lively interest in original work.

We are now five full years behind, but the matter has already been prepared by the unassisted labor of the Secretary for the printer, or for the examination of the publication committee; and certainly there appears no immediate prospect for bringing up the old work, or utilizing the new. We are still in debt for former publication. I am in full accord with the trustees, who are the custodians of the property of the Academy, and who for four years have been endeavoring to reduce the indebtedness of the Academy incurred during the long commercial distress which pervaded the coast.

They have managed the financial affairs of the Academy as they would their own private business, and have earnestly and conscientiously studied how best to husband our resources, and yet grant whatever "aid and comfort" was practicable. They have been able to obtain the moneys needed for actual disbursements through their personal influence at the bank; and we know that whenever it is possible, they will afford the means for publishing. I have trusted that some public-spirited member would appear as a special beneficiary in establishing a publication fund; and I still hope that with the prosperous days of trade we may awaken such a friend to the dissemination of scientific knowledge. The title pages of many scientific publications bear evidence of this liberal spirit.

For scientific research, the munificent endowment of Charles Crocker is so fresh in our memories that I need but refer to it to excit your admiration. That fund plainly mean work, and we believe that valuable scientifi and practical results will be derived from it Upon my application to the trustees, they hav agreed to pay for the printing of a special bul letin of the Academy, in which I propose to give the short but suggestive history of this bequest, for circulation among the scientific societies of America and Europe.

Our donations from correspondents and collectors throughout the coast continue large and valuable, although want of room allows us to exhibit, for the present, only the most interesting. Much time has been given to the classification of our collections by the curators in mammals and birds, ethnology and osteology, botany and mineralogy. There is, however, so much material on hand that we can but regret the lack of work which prevents some of the departments from being properly attended to. To the library constant additions are being received from scientific societies, from individuals and through our representatives in Washington. Nevertheless, we miss several foreign exchanges on account of our not publishing.

As assisting us in a practical, tangible manner, I wish to mention the fact that our fellow-members, Messrs. Gerstle, Goldsmith, Wormser and Niebaum, have again gone upon my bonds for the purchase of 2,000 gallons of alcohol in such quantities and at such times as it may be needed by our wants. By this means we are enabled by law to obtain the alcohol for preserving specimens of natural history without paying the tax thereon. Although the indi-

vidual bonds are large, the gentlemen named promptly acceded to my request.

It is the duty of the president to notice the deaths of members during the year. So far as I have learned, the only member deceased since our last annual meeting, is Mr. Henry Chapman, for many years, one of our most active curators and most modest members, yet full of practical interest in our progress. The academy, very properly, at once expressed its loss and its sympathy with the family.

Again, I urge upon our younger members to file into the ranks of the workers, and to give to the academy some part of their time in classification and identification, as well as the results of their investigations, whether tentative or final. Every search must yield some fresh information and elicit honest commendation. They need not be afraid of having their credit misappropriated, for it has been, to me, a source of great satisfaction to have seen, in 10 years, among so many persons, so little of jealousy, and so much of hearty willingness to commend and encourage.

Among the many subjects which naturally occupy the minds of our members, is the spread of scientific knowledge and scientific methods. Its importance is manifested to us in a thousand ways, and being satisfied of its necessity, and the ripeness of the time for its agitation, I have ventured to put together a few suggestions upon the introduction of elementary science in our public school system, and upon the formation of schools of trade, art, and commerce.

One of the subjects of deep interest that is now occupying those thoughtful men who realize the application of scientific results to practical industry, is the best means of incorporating the elements of this knowledge in the course of an ordinary education, so that it shall enter into and improve the character of our industrial products.

This idea has been quickened by a certain and formidable danger that threatens the higher manufacturing and mechanical industries of our country, in the great and commendable energy with which European nations are urging and extending their systems of special education; fitting the young to be better adepts in their several handicrafts; educating those who combine theoretical acuteness with practical application, to be foremen, masters and teachers; giving every reasonable assistance to the higher class of thought and aptitude.

It is no ordinary question of mere choice of routine; it comprehends the struggle for national supremacy in manufactures.

As our present system of public school instruction is utterly unprepared to meet the demands necessitated by such foreign competition, any change to remedy its defects must be vital and perhaps radical, and will meet with much illogical opposition.

We have always expressed the need of scientific methods in the higher and more thorough system of education, and certainly there must be a necessity for the introduction and application of such knowledge in all elementary education. Hence it seems to me that this Academy, both in its corporate and individual capacity, should not only maintain but express consistent views upon the subject.

One of the means of expressing the necessity for universal scientific education has been in the temporary establishment in different countries of the industrial exhibitions of the manufactures and appliances of industry, and especially of those products which have mainly added to the wealth and prosperity of the nation.

Whilst this lacks depth and universality each exhibition has given impetus to individual efforts which have expanded and influenced the modes of production and the quality of the commodities.

It is deficient in generality because only a comparatively few persons can profit by consulting any special class of machinery or production. These few persons must already be fairly well skilled in order to judge of the relative merits of any process, because the time for examination is limited, and the opportunity for detailed instruction restricted and frequently forbidden.

Whilst these expensive national exhibitions have demonstrated their own inherent weakness as educational factors, they have suggested the better method of "beginning at the beginning," and thence logically developing some system of education suited to the environment of each people and each country.

The very limited and tentative experimentation in Europe in the establishment of trade schools and art schools, has demonstrated their paramount necessity to the nation whose prosperity is mainly dependent upon the productions of handicraft.

Our acknowledged aptness and acuteness in invention has given us a certain position in the world-market of manufacture and trade, but we must yield to others the higher attribute of adding pleasure to the eye by combining beauty and gracefulness with usefulness. It is this combination which gives to France her superiority in the production of textile fabrics and works of art, and we unconsciously but assuredly help to support her factories and her schools of industrial teaching by purchasing at such high rates the output of her workshops.

England has already taken the alarm. Exhibition after exhibition confirmed the statement that in every department of manufacturing industry Continental Europe was abreast and even ahead of her in the make, style and finish of their goods. In the exhibition of 1851 no Englishman received a premium for design. Competition sharpened the inquiries of business men and manufacturers as to the cause. England's cruder products, made and fashioned almost by rule of thumb, were being supplanted by the more eye-satisfying products of Belgium, Switzerland, Germany, Austria and France. Her citizens, made rich through the great opportunities which her coal and iron had made possible, now begin to build and endow colleges for scientific and technological learning, even to the exclusion of classics.

Her far-seeing statesmen, her well-informed manufacturers and her scientific leaders have collectively given the warning, and are endeavoring to mold the educational system to meet the inevitable struggle for commercial and national supremacy.

Among ourselves, we unconsciously appreciate the situation, and tacitly acknowledge the need of higher finishing skill, by securing the services of technologists. In nearly all other countries, these specialists are native and to the manner born. In England this is partially so; but in the United States, we do not hesitate to scour other countries when we

need some specially qualified workman. So true is this, that I know I am safe in saying, that within a very recent period, nine-tenths of the foremen in the workshops of this city were educated in the trade schools, or learned their deftness under a master of the trade in a foreign country; and certainly not more than one-tenth of the skilled workmen among our higher-grade industries have acquired their aptitude from home teaching and experience. I could enumerate many instances which have come within my professional ken and experience, but the enumeration would be invidious, as well as mortifying to our pride.

If, then, success is rapidly rewarding the systematic teaching of handicraft and art to the youth of other countries so that they control the best places in our workshops; if we acknowledge the superiority of many foreign productions, as is proved by the immense importations thereof; if we propose to increase our national prosperity, and acquire manufacturing, commercial and agricultural superiority; if we are met at the very threshold of our social fabric by the pertinent and penetrating question, "What shall we do with our boys?"—does it not strike you that we should learn more minutely what has been done at those industrial centers whence we call for skilled workmen, and whose workshop products are preferred to ours?—that we should profit by their experience?

The natural advantages are with the youth of America, as is shown by our inventive skill, by daring and successful engineering, by the restless mental activity of young life.

It would seem, therefore, that the youth of to-day, who are to lead to-morrow, need a different system for guiding, developing and applying their faculties, from what now exists. This conclusion is fortified by the establishment of a limited number of special schools of technology in the Atlantic States, and the forced, tardy, and yet wholly insufficient introduction of science in the curriculum of some of our colleges. These advances have only made a start in the great centers of industry and population, and the public mind seems unfortunately to have accepted the long unchallenged assertion that a common school education is amply sufficient for the young American; and that his quickness and aptness will in some "royal way" fit him for any position he names. This is simply a monstrous mistake.

I earnestly believe in universal education, and in carrying it to its legitimate conclusions. It is a necessity of the age; it cannot be set aside if we would. But I believe in its being so construed that the blacksmith shall understand the character of the material and tools he is using; that he shall have skill to use neither too much nor too little metal; and that his productions shall have the best shape for strength and beauty combined. That the joiner shall know the peculiarities of the woods and tools he is working with, and that he shall he shall use them to the best advantage. That the weaver shall know how to produce the best goods for wear, as well as those wonderful creations of textile fabrics which are a marvel to the eye of taste. That the wood turner, the metal worker, the instrument maker, shall, by deftness of hand and accuracy of eye, more than rival the artisans of other countries.

The present school system has spoiled tens of thousands of artisans; but it has in a measure only repeated the experience of other countries. To state its results mildly, it may be said to create a disposition in the pupils to avoid those occupations which demand manual labor, and to seek those easy berths where somebody else does the work. It creates a false standard of manliness. It covers a multitude of incongruous subjects, and lacks completeness and thoroughness in any one of them.

To those who have the capacity and the support to follow its higher courses, it does offer a more apparent completeness and thoroughness. But I contend that from the standpoint of availability to meet the exigencies of daily life, from the standpoint of national superiority in manufactures, mining, commerce, engineering and agriculture, it is absolutely necessary that the system should be fitted to the needs and wants which the sharp competition for such supremacy demands. It is not the struggle of one man, or of one city, or of one State against a friendly neighbor; it is the battle of industrial life of 50,000,000 people—of 100,000,000 within a generation—against the experience and more readily molded compact populations of Europe, guided by keen manufacturers, special technologists, trained educators, and broad-viewed statesmen.

I do not deprecate the wisdom of our really great men in education, in statesmanship, in science, in manufactures—on the contrary, I hope to see their wishes and efforts come to fruition. You have but to consult the reports of our Commissioners to the Paris Exposition of 1878 to be satisfied of their thorough knowledge of the situation, and of the earnestness of their awakening call. If I were, however, to reproduce their criticisms you would pronounce them cynics; nevertheless they were the representative men in education, in art, in manufactures; they were alive to the progress around them; they were lifted above provincialism to the higher plane of nationality. They gauged the active and the passive nations—the one colonizing the earth through ship, machine and free speech—the other enjoying the delicous listlessness of drifting down stream.

I may but refer to what other countries are doing to afford such practical education to their youth as will give them pre-eminence in their different handicrafts.

France has her school workshops, which are established upon the proposition that whatever be the actual fixed calling of the youth, there is a certain number of leading subjects of education common to all, and to which the instruction intended for artisans should conform; and this course is combined with a continuance of regular school instruction, and perhaps it may not be imposing upon your patience to enumerate the subject matters included in the general programme of one of the most successful workshop schools in Paris.

1. The continuance of school instruction, somewhat modified from its present type; the maintenance of examinations which shall give the right to the certificate of primary education.

2. Study and management of raw materials.

3. Drawing from patterns in relief, modeling, molding, sculpture upon soft stone, marble and wood, graphic drawing and ink shadings.

4. The practice of general processes and tools; work at the bench, at the forge, at the lathe, at

the vise; elementary specialization when the pupil has in view a particular industry.

5. General technical education and specialization of that part which bears on the chosen trade; book-keeping; industrial and commercial geography; first elements of economy.

6. Delineation with scale and dividers of a piece of finished work or a machine; working plan on a given scale; sketch or free-hand drawing; reciprocally, execution after a working plan on a given scale, or after a rough draught.

7. Invention, plotting, execution of simple plans.

8. Morals, duties of men, the child, the laboring man, the man of property, men in mutual relations, the head of a family, the citizen, and the country.

9. Habits, personal order, order in tools, order in labor, order in the shop, order in accounts, order in thought, spirit, and hence in conduct.

Upon this basis are planned the different workshops for different trades; the allotment of practice and study; and all the minutia of detail which a systematic organization demands.

Combined with the system are the journeys of instruction, which embrace the visiting of workshops, collections and works of construction, upon which reports are made by the pupil visitors. In these journeys a specified number of pupils are selected from certain schools on account of their diligence and proficiency, to visit the great centers of industry—extending even to adjacent countries. The details of all such excursions made out as reports by the pupils, are exceedingly interesting and instructive.

There are numerous technological schools throughout the republic; a national school of Horology at Cluses, and commercial schools and schools of navigation at Havre, Marseilles and other cities.

Moreover, the adult population is not forgotten; and besides the encouragement given to public adult instruction, there are special free schools for adults, particularly for the teaching of drawing, and evening schools to meet the cases of those who appreciate the need, and now first find the opportunity for education.

The results of these different classes of schools has been remarkably instructive and encouraging, and will gradually lead to a thorough and more homogeneous system throughout the country. At present, the plan of education is but emerging from the control of the clerical party, and coming in contact with the realities of active business life.

In Russia, the great technological schools of Moscow and St. Petersburg have shown their capacity and their influence, and the workmanship of the pupils created astonishment and admiration among our instructors and mechanicians who examined their exhibits. They rival our best efforts.

In Germany, in Austria-Hungary, in Switzerland, the Netherlands, Belgium, and other countries, we find that the trade and art schools are gradually but assuredly raising the character of the artisans' work, and necessarily adding to the mercantile value of their prodcutions.

England has awakened to the necessity for a better and more adaptable education to her artisan classes, and for a more cultivated taste and execution among her skilled workmen. For years she rightly considered herself at the head and front of manufactures, but little by little the truth dawned upon the minds and pockets of her manufacturers that the progress of foreign workmanship could not be attributed altogether to the greater industry and lower wages of the workmen, but that the cultivated intelligence derived from attendance and study at trade and workshop schools, and technological institutions was the secret of successful competition. Those immediately interested saw that the same character of education must be imparted to the British workman; but in a country so conservative of old customs the greatest tact was necessary to introduce new methods.

But that most sensitive of all nerves, the pocket nerve, has quickened the commercial and manufacturing instinct, and to-day the mystery has become a conviction.

The first outcome was the establishment of the Leeds Textile School, founded by the munificence of the Cloth-workers' Company of London, but owing its existence to the pressure of the Leeds manufacturers. Then followed the Glasgow Technological school, profiting in its organization by the experience of the Leeds school. Later, the example was enthusiastically adopted by Bradford; and elsewhere the idea has germinated, and classes and schools have been formed. In no direction is there any indication of aught but success; the advantages of these schools are earnestly and even enthusiastically embraced by workmen.

And so might the story be continued. I have only made the matter suggestive for action.

But I cannot refrain from quoting the warning of others. The U. S. Commissioner of Ed to Paris in 1878, says:

"We are behind Europe in the education of the powers of observation and manipulation. The sharp competition of the different countries of Europe demand the cultivation of the eye and the hand, and long practice has given an aptitude and ability transmitted perhaps as an inheritance, and so become a second nature. But we certainly need to do a great deal more in this direction, and we cannot begin it too soon. If the brain of man conceives the strategy by which we master nature, it is by the eye and the hand that the real victory is to be achieved. A large amount of the educational effort of this country is directed to sharpen the wits and quicken the inventive genius of our people, but our lack in bodily training will before long make itself painfully evident."

Of course we have not forgotten the existence of the few higher technological institutions of the United States, nor their high rank and efficiency, but my especial object has been to insist that in our ordinary public schools we have not professed to reach that point of necessary useful knowledge, much less its application, which our status as a manufacturing and commercial nation demands.

You will ask how our youth are to receive that instruction which shall fit them for successful competition in the struggle for national superiority in manufactures and commerce.

The answer cannot be given impromptu; we must, to a certain extent, be guided by the experience of other countries, and must comprehend their political and social organizations for comparison with our own, to understand what we shall adopt and what modify. All their systems of trade, workshop, and commercial schools have grown up with local constrictions, and yet have a national object in view. They

had many serious obstacles to overcome, perhaps more than we have, for they had less freedom of personal action and thought. We have more of individual independence, which may aid in developing special schools for trade and art, more particularly in those centers demanding them.

Nevertheless, whatever be the ultimate character of our common education, there are certain fundamental branches of knowledge underlying all trades and productions. These come under the general designation of science; and the elementary laws thereof, and their practical application to the manufactures, agriculture and mining of this country are not beyond the scope of our present public school system; nor beyond the readily assimilative power of our pupils. Whoever has come into contact with our youth will fully bear me out in that conclusion. And whoever has had a varied experience with young men, grown up from the ordinary public schools, will be astonished at their lack of knowledge of the fundamental principles which underlie their workmanship. They have in general an amount of undigested and incoherent material which their teachers have christened knowledge, and which their inexperience considers applicable for any and every pursuit. For example, one of the commonest wants of pupils throughout the country is their inability to draw upon paper any plan of roads with which they are familiar, any sketch of the plainest machine of every day use, much less to convey any idea which looks to an improvement or an invention in machinery or construction. I feel perfectly safe in saying, from my experience, that not one person in a hundred from our public schools can give you an off-hand drawing of any plain object, with any approachable degree of accuracy as to relative dimensions or perspective.

This is not the fault of the pupils who, as a rule, are naturally quicker and brighter than the youth of Europe; but it is the inherent weakness of the system, and a painful evidence that we are not doing our duty to our boys

Again, you ask, can these deficiencies be corrected in our present system? I answer, yes; in a measure. Time is required to mold and develop the proper system of trade and art schools, of evening and navigation schools suitable for this side of the continent at least; and pending this, we can certainly engraft upon our methods the proper study of elementary science, and especially connect therewith the free-hand drawing which is the *sine qua non* in every school of the active nations of Europe Our youth who are to build up the industrial supremacy of this country need not be crammed with foreign languages, which in a few years must be pressed aside before the irresistible progress of the English-speaking races; and it is a thousand times better that the boy who is to honestly earn his livelihood as an artisan, shall be a fair draughtsman than a fair fiddler. If his special talents point to music, then let that faculty be thoroughly cultivated; but do not waste means in spoiling a good carpenter, or in endeavoring to misdirect special aptitude. The classics, music, and the fine arts have their high places and their humanizing functions in modern civilization. So has the bridge-builder, the miner, the engineer and the contractor.

Life is too short for us to repair the errors of early education; the State loses by the misapplication of talent. We need not wilfully throw our wealth into the depths of the Pacific.

There are many important conditions attached to this subject of science-teaching, and of trade and art schools, especially when we contemplate how extensively great corporate bodies are gathering into their hands the manufacturing processes of the country, and apparently swallowing up individual efforts; but each year the demand for skilled labor increases, and we must meet the difficulties of the problem as the number of factors is increased. We may never see very far ahead into the unknown—we should never be one step behind the requirements of the present.

I cannot, however, enter upon the consideration of the many actual and speculative phases involved and which are intensely interesting. I have simply endeavored to do a part of my duty as a citizen, and as a member of this Academy, in calling attention to the absolute necessity which exists for properly educating and fitting our youth for the duties which will be demanded of them in the struggle for national supremacy in material wealth.

RETURN TO the circulation desk of any
University of California Library
or to the
NORTHERN REGIONAL LIBRARY FACILITY
Bldg. 400, Richmond Field Station
University of California
Richmond, CA 94804-4698

ALL BOOKS MAY BE RECALLED AFTER 7 DAYS
2-month loans may be renewed by calling
(415) 642-6233
1-year loans may be recharged by bringing books
to NRLF
Renewals and recharges may be made 4 days
prior to due date

DUE AS STAMPED BELOW

NRLF PHOTOCOPY MAR 31 '89

JUL 31 1998
APR 26 2001
FEB 10 2005

U. C. BERKELEY LIBRARIES
C054900113